ENVIROSCAN, INC.

ORIGINAL

Final Report
Geophysical Survey
Flow Laboratories Site
Dublin, Pulaski County, VA
Enviroscan Project Number 069911

Prepared For: Roy F. Weston, Inc.
Prepared By: Enviroscan, Inc.
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1051 Columbia Avenue • Lancaster, Pennsylvania 17603 • 717/396 8922 • Fax 717/396 8746 • email@enviroscan.com • www.enviroscan.com

GPR

In order to provide an independent method of detecting non-metallic targets (i.e. carcass trenches and a leaching field), Enviroscan performed GPR scanning using a GSSI SIR-3 system. The system included a controller, a VDU color display monitor, and a shielded monostatic 500 megaHertz scanning antenna (generally capable of scanning to a depth of 8 to 10 feet while screening out interference above ground or overhead structures and utilities).

GPR systems produce cross sectional images of subsurface features and layers by continuously emitting pulses of radar frequency energy from a scanning antenna as it is towed along a survey profile. The radar pulses are reflected by interfaces between materials with differing dielectric properties. The reflections return to the antenna and are displayed on a video monitor as a continuous cross section in real time and/or recorded for further analysis. Since the electrical properties of metals are dramatically different from soil and backfill materials, metallic objects produce distinct reflections. In particular, cylindrical tanks, drums, and utilities characteristically appear as smooth parabolic reflections on GPR records. Fiberglass, plastic, concrete, and terra-cotta targets as well as subsurface voids, rock surfaces, soil composition or moisture content variations, and concentrations of many types of disseminated metallic and non-metallic wastes also produce recognizable reflections.

The GPR survey was accomplished by hand-towing the scanning antenna across all areas of the site where the vegetation was sufficiently low to allow good signal coupling between the antenna and the ground surface. These areas included paved, gravel and dirt roads and paths, mowed fields, and some brushy areas with sparse ground cover. The profiles were inspected in real time as the survey progressed to identify parabolic reflections of the type commonly associated with utilities, or distinct/discrete zones of soil disturbance of the type commonly associated with pits or trenches. Where anomalous reflections of the type that might be associated with utilities or trenches were detected, numerous closely spaced and variously-oriented profiles were scanned to provide detailed delineation of the anomaly footprint.

Example GPR field records (from lines A-A' and B-B' – see Figure 2) are included as Figure 4. Figure 4 also depicts the EM terrain conductivity and inphase data coincident with each GPR record. Anomaly footprints were marked in the field with wire-stem vinyl flagging, were surveyed using DGPS, and are depicted on Figure 5.

Utility Mapping

A utility mapping survey was completed on June 16, 1999 using a Fisher TW-6 radio frequency EM pipe and cable tracer and a Radiodetection C.A.T. and Genny pipe and cable locator/tracer. The TW-6 is essentially a deep-sensing metal detector that detects highly electrically conductive materials by creating an electromagnetic field with a transmitting coil. A receiving coil at a fixed separation from the transmitter measures the field strength. As the instrument is swept along the ground surface, subsurface metallic bodies distort the transmitted field. The change in field strength is sensed by the receiver, setting off an audible alarm and/or causing deflection of an analog meter. The TW-6 can nominally detect a 2-inch metal pipe to a depth of 8 feet and a 10-inch metal pipe to a depth of 14 feet. In pipe and cable tracing mode, the TW-6 transmitter can be coupled directly (conductively) to exposed portions of a metallic pipe, cable, or wire or inductively to a subsurface metallic utility with known location and orientation. The transmitter remains stationary and energizes the utility to be traced with an 81.92-kilohertz signal that can be traced at the ground surface using the mobile TW-6 receiver. Depths to metallic utilities can be determined (to within approximately 0.5 feet where possible) using inductive or conductive mode triangulation.

The utility mapping survey also employed a Radiodetection C.A.T. and Genny pipe and cable locator and tracer. In pipe and cable search mode, the C.A.T. detects the magnetic field from the electric current flow on a conductor (metal pipe or cable). In Power mode the C.A.T. detects the 50/60 Hz energy signal present on most buried power cables and on other nearby cables or metallic pipes. In Radio mode, the C.A.T. detects buried conductors (cables or metallic pipes) as they re-transmit commercial broadcast radio energy. In Genny mode, the C.A.T. detects signal generated by the Genny transmitter. The Genny transmitter can be coupled directly (conductively) to exposed portions of a metallic pipe, cable, or wire or inductively to a subsurface metallic utility.

Results

The results of the geophysical survey are depicted in Figures 2, 3, 4 and 5. As described above, the EM inphase and terrain conductivity data represent primarily the shallow subsurface materials (i.e. less than 30 feet, with a peak response near 4 feet), with contributions from above-ground targets where the data coverage is within approximately 20 feet of surficial metallic materials. Based on these sensitivity characteristics, the EM data (Figures 2 and 3) suggest the presence of utilities along the road bounding the eastern edge of the site, and crossing the southern portion of the site on a northwesterly heading. Apart from these anomalies, there are no EM terrain conductivity nor inphase variations indicative of the suspected survey targets (i.e. carcass trenches or a septic leaching field.

GPR scanning detected linear alignments of parabolic reflections of the type consistent with a septic leaching field containing rows of non-metallic (probably terra cotta) drain tiles. The GPR reflection pattern is depicted in Figure 4-A, and the inferred pattern of pipes based on the GPR scanning is depicted in Figure 5. GPR scanning did not detect anomalies of the type consistent with pits or trenches (see e.g. Figure 4-B). Instead, GPR records from the southern area of the site are quite featureless with small apparently randomly distributed parabolic reflections of the type consistent with the presence of rounded river terrace cobbles (as could be observed at the ground surface throughout the site).

GPR scanning and radio frequency EM tracing detected the utilities suggested by the EM data. Tracing of these utilities to surficial structures allowed identification of their types (i.e. fire protection, telephone and sewer). Note that during tracing of the fire line crossing the southern portion of the site, it was noted that the utility trace was occasionally marked by subtle depressions of the type which (in the absence of knowledge of the fire line) could be mistaken for evidence of caracass burial trenches.

In conclusion, the geophysical survey did not detect any EM or GPR evidence of the rumored carcass burial trenches. The survey did detect and delineate two septic leaching fields as evidenced by networks of non-metallic pipes. However, the EM data do not suggest the presence of a leachate plume or otherwise anomalous soil moisture in the leaching field.

Limitations

The geophysical survey described above was completed using standard and/or routinely accepted practices of the geophysical industry and equipment representing the best available technology. Enviroscan does not accept responsibility for survey limitations due to inherent technological limitations or site-specific conditions. However, we make every effort to identify and notify the client of such limitations or conditions. In particular, please note the utility mapping survey does not relieve any party of any legal obligation to notify a utility marking or one call service prior to digging or drilling.

Enviroscan has appreciated this opportunity to work with you. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,
Enviroscan, Inc.

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Technical Review By:
Enviroscan, Inc.

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enc.: Figure 1: Geophysical Survey Data Coverage
Figure 2: EM-31 Terrain Conductivity
Figure 3: EM-31 Inphase Response
Figure 4-A: Example GPR Profile – Inferred Leaching Field
Figure 4-B: Example GPR Profile – Suspected Trench Area
Figure 5: Utility Survey Results Summary
Appendix A: EM-31 Depth Sensitivity